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# SAWFLY BIOLOGIES.

## 1. NEODIPRION TSUGAE MIDDLETON.

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The western hemlock sawfly, *Neodiprion tsugae* Middleton, first came to our notice from the Queen Charlotte Islands, British Columbia. In 1931, reports of the dying of hemlocks over large areas came from rangers and timber operators of this region. A survey conducted by Mr. W. G. Mathers of the Dominion Entomological Branch, in September and October of that year, indicated that the injury extended over approximately forty square miles. In 1932, the outbreak showed definite signs of subsiding, and had practically disappeared by 1933, although many trees were killed during the peak year of 1931, indicating that this is a primary enemy of western hemlock, and that outbreaks may be expected from time to time in the Pacific Northwest.

During 1932 and 1933, the seasonal history of this sawfly was observed at Vancouver, B.C., both under field and under laboratory conditions, and the appearance of the various stages noted. The object of this paper is to describe the stages and habits in sufficient detail for identification purposes, and to present an account of the seasonal development. The terminology is that of Middleton (1921).

### ADULTS.

Dr. Middleton (1933) characterizes the adults as follows:—"A yellow-brown species with the flagellum dark brown to almost black and blackish markings on the thorax. This species belongs to the group which has the scutellum polished and impunctate and is related to *N. abietis* (Harris), *N. edwardsi* (Norton), and *N. scutellatus* Roh., but may be separated from them as follows: In *N. tsugae* and *N. abietis* the pads of the sheath are short and oval, about twice as long as wide, only about one-third the length of the portion of the sheath of which they form a part, and distinctly on the apex of the sheath; in *N. edwardsi* and *N. scutellatus*, however, these pads are about three times as long as wide, about one-half the length of the portion of the sheath of which they form a part, and distinctly on the longitudinal aspect of the sheath. The female of *N. tsugae* can be distinguished from that of *N. abietis* by having shorter rami on the flagellum. The rami on joints 2 to 9 of the flagellum of *N. abietis* are as long as the joints are thick, whereas the rami of the flagellum of *N. tsugae* are shorter than the joints are thick."*

The type locality is Carroll Inlet, Tongass National Forest, Alaska. Paratypes are from Alaska and Queen Charlotte Islands, B.C. Additional specimens in the U. S. National Museum, not included in the type series, are from Astoria and

*For a complete description of the adults see Middleton (1933).

Contribution from the Div. Forest Insects Entomological Branch, Dept. of Agriculture, Ottawa.

Nea-Ka-Nie Mountain, Oregon, and Ketchikan, Alaska.

According to Dr. Middleton, the antennae of both males and females vary in number and character of segments. As a rule, a male antenna consists of 19 segments, the first of which is uniramose and the remainder biramose except the terminal one, which is beadlike.

THE EGG.

The egg is 1.12 mm. long, ovoid, rounded at one end, somewhat pointed at the other, translucent white when deposited, later becoming yellowish. Near hatching time, the black eyespots are very prominent, and the central portion of the egg also becomes dark. Immediately before hatching the embryo can be seen distinctly.

THE LARVA.

It is probable that in some cases (females ?) there may be six instars. The number of instars noted is based upon head capsule measurements, using about ten larvae in each class. It is not easy to determine the number of moults because it is rather difficult to raise isolated larvae and when larvae are reared in a colony the various instars overlap. The head capsule measurements indicated five instars, and some larvae taken from cocoons were fifth instar larvae.

*First instar*: Colour almost black, head capsule shining black; length 2.00 mm., width of head capsule, .50 mm.

*Second instar*: As in the first instar, with a somewhat greasy appearance; length 5 mm.; width of head capsule, .66 mm.

*Third instar*: Colour still quite dark, with a greenish tinge commencing to show and final longitudinal stripes faintly indicated. Length 7 mm., width of head capsule, .91 mm.

*Fourth instar*: Longitudinal stripes clearly defined as in the fifth instar; length 12 mm., width of head capsule 1.16 mm.

*Fifth instar*: Length 16-18 mm., width of head capsule 1.36 mm. The body is notably tapered from the thorax caudad, producing a slightly humped appearance. The general colour varies from dusky, green to yellowish and sometimes gray, with darker longitudinal stripes disposed as follows:—On each side a broad, sub-dorsal, medium-dark band; a narrower, darker band, the most prominent, above the line of spiracles. A series of narrower, less distinct, sub-spiracular dashes and a narrow dark stripe above the hypopleurites, crossing the post-epipleurites, briefly interrupted between the latter.

*Head*: Shining black, approximately round when viewed from the front, semiglobular from the side. The ocellus is translucent, semiglobular, situated .81 mm. from the top of the head and .33 mm. from the posterior margin of the capsule. The heavily pigmented area surrounding the eye is scarcely differentiated from the remainder until after the larva spins its cocoon. The entire body then becomes white, the head pale testaceous, except the sub-circular area surrounding the eye, which remains very dark. The antenna is situated a little more than halfway from the eye toward the base of the mandible. It consists of a short peglike cone surmounting a sub-circular shallow protuberance which, according to Yuasa (1922), consists of two antennal segments. The epicranial suture is con-

tinuous to the foramen, the lateral arms delimiting a broad, shield-shaped front and meeting at a very shallow angle, .66 mm. above the epistomal suture. The labrum has strongly arcuate lateral margins, and is deeply emarginate at the apex; it bears four prominent setae placed in a straight transverse line. The mandible is subquadrate in outline, stout, typically with five teeth. The maxillary palpus is four-segmented, the first three segments sub-cylindrical, successively diminishing in size, the terminal one much smaller, conical, with rounded apex. The galea is thumb-like, shorter than the palpus; the lacinia bears a prominent, blade-like digitus which is curved at the tip, and several setae. The labial palpus is two-segmented, the terminal segment shaped like that of the maxilla. The basal segment is cylindrical and resembles the palpiger beneath. The submentum is emarginate apically, the lateral margins are arcuate; the mentum is U-shaped; the ligula is feebly trilobed, indicating glossa and paraglossae.

*Metathorax*: There are typically four annulets to a thoracic segment. In the metathorax annulet (see Plate II) 1 is the broadest, 2 is next in breadth, 3 and 4 are about equal in breadth, and narrower than 2. The sutures between 1 and 2 and between 2 and 3 are incomplete. Annulets 1, 2 and 3 each bear a transverse row of stout spines (the glandubae of Yuasa 1922). The pre-epipleurite bears about ten of these spines, the post-epipleurite and the post-hypopleurite two or three each.

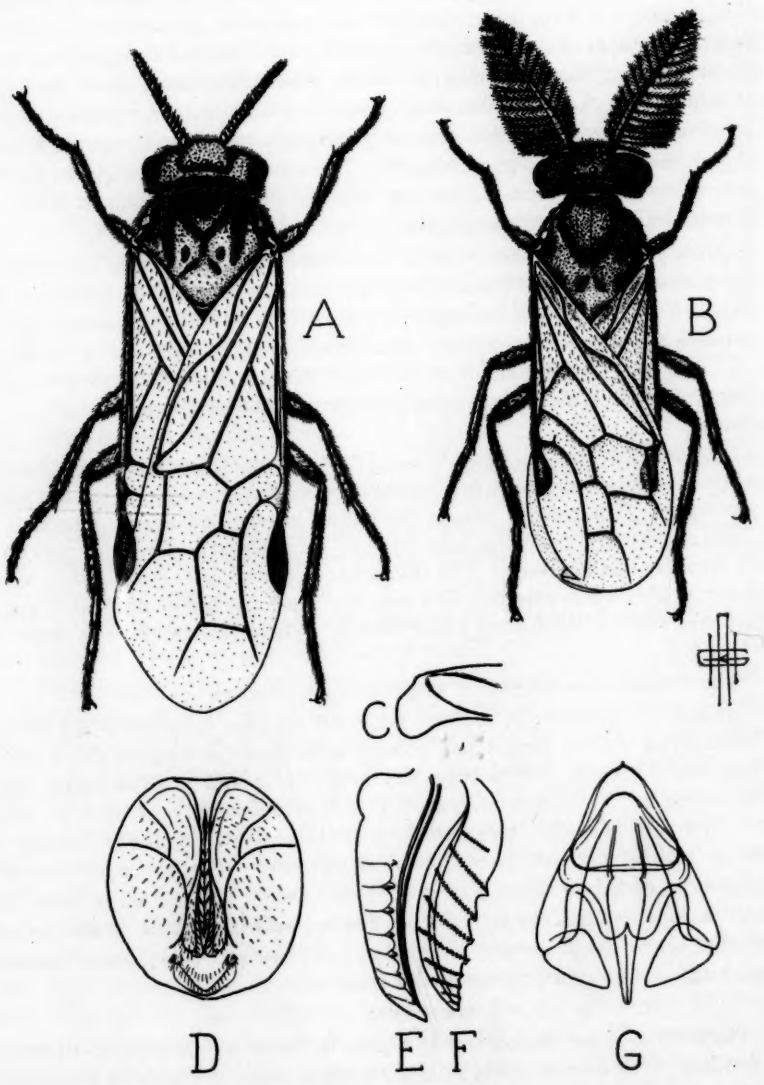
The metathoracic leg, viewed from a cephalic aspect, presents the following features:—The tarsus and claw are fused into one piece, the former indistinguishable externally. The claw is simple, moderately curved and acute. The tibia is quite strongly tapered from the base distally. The femur is larger distally than basally, strongly lobed beneath. The trochanter is much larger distally than basally, not appreciably lobed beneath. The coxa and pre-hypopleurite are both triangular, (cephalic aspect), the former lobed beneath. The pigmentation is as shown in Plate II, fig. J.

The mesothoracic spiracle is small but quite distinct.

*Abdominal segment*: A typical abdominal segment, as exemplified by the third, consists of six annulets, 1 and 2 being about equal in breadth and broader than the rest. Annulet 6 is a little less broad, 3, 4 and 5 about equal, each narrower than 6. Annulets 1, 2 and 4 each bear a transverse row of stout spines. The post-spiracular area has three of these spines, typically forming a triangle on each of the first four abdominal segments. The pre-epipleurite and post-epipleurite each bear about 6 or 7 of these spines. The uropod is longer on the anterior face than on the posterior. The spiracle is situated on the second annulet just below the prominent longitudinal dark stripe. The suture between annulets 1 and 2 has a distinct angle at this same band.

## COCOONS.

The cocoon of the female is 7 to 8 mm. in length by 3.0 mm. in diameter, ovoid in shape. The cocoon of the male is similar in shape to the above but is 5 to 6 mm. in length by 2.5 mm. in diameter. The cocoon is of a rather rigid papery texture varying from light gray to brown with a somewhat silvery sheen. The inside of the cocoon is reddish brown, darker than the outside, and shows a dark band around the middle when held to the light, apparently caused by a thick-




*Neodiprion tsugae* Middleton

A. Female. B. Male. C. Aedeagus. D. Saw in situ. E. Saw guide. F. Saw. G. Male genitalia.

ening of the cocoon walls at that point. This band is sometimes evident on the outside of the cocoon being a little lighter than the remainder.

### OVIPOSITION.

Egg-laying at Vancouver occurs during late August and throughout the greater part of September. On the Queen Charlotte Islands, which are 250 miles north of Vancouver, egg-laying takes place during the latter half of September and first half of October. The average number of developed eggs per female as found on dissection of ten females was 72.5. The greatest number found was 103, the least, 61.

The female cuts a slit near the edge of the needle on the underside, and hollows out a narrow, elongate chamber in the leaf tissue. In this she deposits the egg. There is a fringe or bundle of dark shreds around the opening of each egg slit, representing the leaf tissue pulled out by the saw. Most needles show only one egg, but some have from 2 to 5. The eggs can be readily seen by holding a branch up against the light, when the eggs show yellow in contrast to the green of the remainder of the needle. A surprising number of eggs are not properly inserted into the egg slits and are left partly protruding or entirely outside.

There is no appreciable change in the appearance of the egg during the winter, but in early May there is a darkening of the central area, the eggs enlarge, causing the slits in the needle to gape open. The eye spots are conspicuous, and the embryo becomes clearly discernible. Egg-laying was observed to take place only on western hemlock, *Tsuga heterophylla* (Raf.) Sarg.

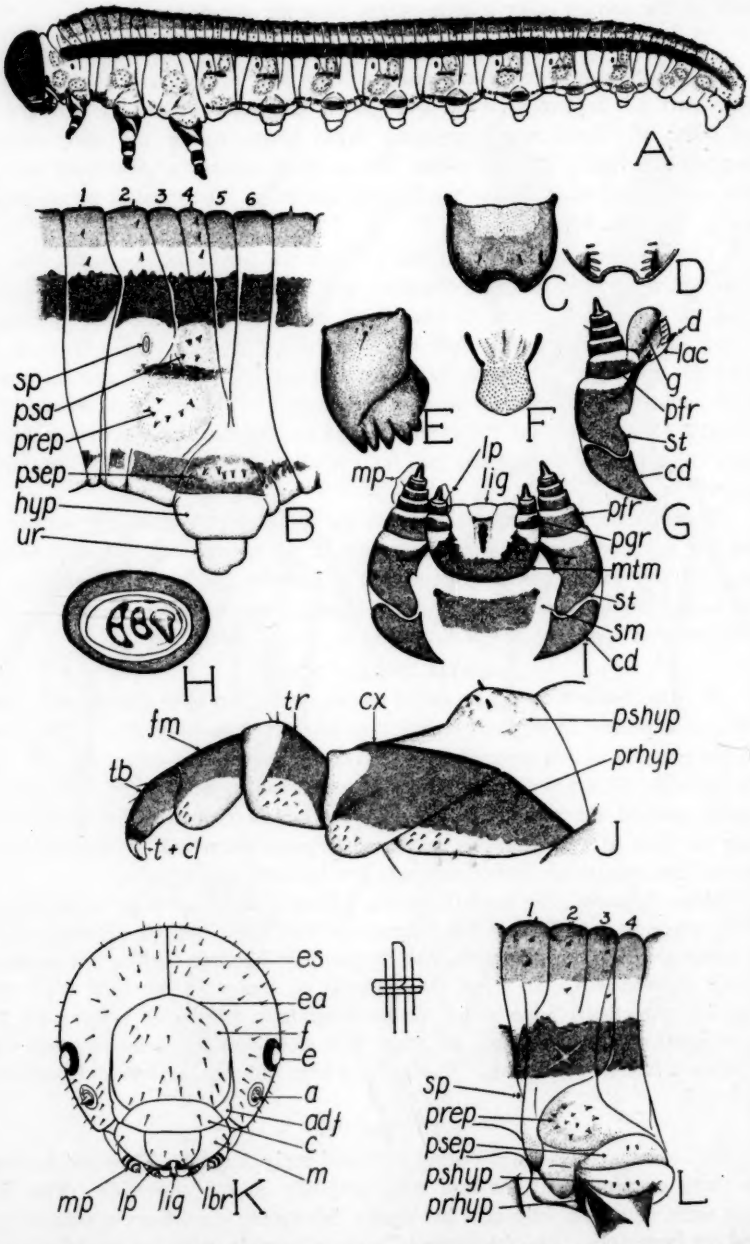
### LARVAL DEVELOPMENT.

In 1932 the first larvae appeared on May 17th, but eggs continued to hatch for at least a week. In 1933, first hatching was noted on May 20th. The young larvae are gregarious and commence to feed on the old needles rather than the new spring growth. Characteristically, several larvae congregate on the same needle, all facing toward the tip, and consuming the needle from the tip to the base. During the first part of June, as the larvae become about half-grown, they tend to become less gregarious, and to consume both old and new growth.

When disturbed, the larvae have the typical *Neodiprion* habit of holding on with the uropods and flicking the forepart of the body, instead of the habit of many other sawflies, of holding on with the thoracic legs and flicking the posterior part (e.g. *Nematinae*). In 1932, the majority of larvae in the field cage were nearing full growth by June 27th. Under laboratory conditions, a larva reached full development by June 9th. In 1933, this state was not attained until July 10th under field cage conditions. Larvae have been observed to feed only on western hemlock.

### SPINNING UP.

The cocoons are formed during July and early August. They are fastened to the twigs or needles of the host tree, generally on the underside. The first cocoons were noted on July 4th, but under laboratory conditions a cocoon was secured on June 10th. On the Queen Charlotte Islands, spinning up takes place in late August and early September. The actual length of the pupal stage was not observed, but the length of time between spinning up and emergence is thirty




A. Neodiprion tsugae Middleton—fifth stage larva. B. Third abdominal segment. C. Labrum. D. Epipharynx. E. Right mandible. F. Hypopharynx. G. Right maxilla. H. Antenna. I. Labium and maxillae. J. Right metathoracic leg, view from cephalad. K. Head front view. L. Metathorax, lateral view.

to thirty-five days under field cage conditions. In the laboratory, this period was reduced to twenty-eight days.

EMERGENCE.

In 1932, emergence at Vancouver was as tabulated below. The 415 cocoons placed in the laboratory cage were taken from the field cage between July 16th and Aug. 2nd, in order to reduce the egg-laying in the field cage. In so doing, most of the cocoons formed at an early date were probably taken in and therefore it seems reasonable to suppose that if they had been left outside, the emergence would have been about as early in the field cage as in the laboratory.

| Date | Laboratory cage. | | Outside cage. | |
|---|---|---|---|---|
| | Males. | Females. | Males. | Females. |
| Aug. 8 | 5 | 2 | | |
| 11 | 5 | 1 | | |
| 15 | 9 | | | |
| 16 | 8 | 3 | | |
| 17 | 4 | | | |
| 18 | 8 | 1 | | |
| 19 | 12 | 6 | | |
| 20 | 6 | 1 | | |
| 22 | 13 | 22 | 1 | |
| 23 | 16 | 18 | 1 | |
| 24 | 13 | 20 | 3 | 1 |
| 25 | 9 | 17 | 1 | 1 |
| 26 | 18 | 27 | 2 | |
| 27 | 6 | 15 | 2 | 1 |
| 29 | 12 | 23 | 11 | 4 |
| 31 | 13 | 8 | 2 | |
| Sept. 1 | 1 | 2 | 10 | 4 |
| 2 | 2 | | 6 | 4 |
| 6 | 1 | 2 | 32 | 32 |
| Total: | 161 | 171 | 71 | 47 |

The males are very pugnacious, often biting off the antennae of other males and even those of females. The males may often be found clinging to cocoons which contain females. In copulation the male backs up to the female, and the two face in opposite directions throughout the procedure. This seems to be common to most of the sawflies. In each of the eight cases observed, copulation lasted about ten minutes.

PARTHENOGENESIS.

Eight pupal cases containing females were placed in individual vials to prevent fertilization. Between Sept. 8th and 12th, three of these females were placed in a cheesecloth bag enclosing a spray of hemlock on a caged tree. No eggs had been deposited on the tree previously. At least twenty eggs had been deposited by Sept. 26th. On the following May 27th, these eggs hatched and by June 20th the larvae were one-fourth grown. The first cocoon was noted on July

15th. Five cocoons were recovered and placed in individual jars. The rest of the larva apparently died. On August 26th one of these cases was opened and found to contain a fully-formed male. Subsequently, three more males emerged. However, the number of cocoons used was insufficient to indicate that only males result from parthenogenesis.

### PARASITES.

The following Hymenopterous parasites emerged from pupal cases of *Neodiprion tsugae*. Determinations were made by the Division of Systematic Entomology, Ottawa.

*Delomerista* sp.; *Phaeogenes hariolus* Cress.; *Phaeogenes arcticus* Cush.; *Pezoporus* sp.; *Olesicampe* sp.

The numbers of cocoons and parasites were not sufficient to indicate a reliable percentage of parasitism.

### SUMMARY.

Injury to hemlock over an area of forty square miles on the Queen Charlotte Islands in 1931 led to a study of the seasonal development and habits of the insect responsible, *Neodiprion tsugae* Middleton. This sawfly is closely related to *Neodiprion abietis* Harris, *N. edwardsi* Norton and *N. scutellatus* Rohwer, being a yellow-brown species with flagellum dark-brown to almost black, and blackish markings on the thorax (female). The male is black. The larva is 16-18 mm. long when full-grown, dusky green to yellowish and sometimes gray, with longitudinal dark bands. The seasonal development is as follows:—In the vicinity of Vancouver, the yellow ovoid eggs are inserted in slits in the hemlock needles during late August and the greater part of September. These hatch the following May, the larvae feeding through June, spinning up during July and early August. The time spent in the brownish-gray pupal case is about a month, emergence taking place during August and early September. There is but one generation a year. Five hymenopterous parasites have been reared from the larvae or pupae.

### LITERATURE CITED.

Middleton, William. 1921. LeConte's Sawfly, An Enemy of Young Pines. Jour. Agr. Res. 20, (10), 741-760.

Middleton, William. 1933. Five New Sawflies of the Genus Neodiprion Rohwer, Can. Ent., 65, (4), 77-79.

Yuasa, Hachiro. 1922. A Classification of the Larvae of the Tenthredinoidea, Ill. Biol. Monog., 7.

### SYMBOLS.

a—antenna
adf—adfrons
c—clypeus
cd—cardo
cl—tarsal claw
cx—coxa
d—digitus
e—eye
ea—epicranial arm
es—epicranial stem
f—frons
fm—femur
lp—labial palpus
m—mandible
mp—maxillary palpus
mtm—mentum
pfr—palpifer
pgr—palpiger
prep—pre-epipleurite
prhyp—pre-hypopleurite
psa—post-spiracular area
psep—post-epipleurite
pshyp—post-hypopleurite
sm—submentum

g—galea
hyp—hypopleurite
lac—lacinia
lbr—labrum
lig—ligula
sp—spiracle
st—stipes
t—tarsus
tb—tibia
tr—trochanter
ur—uropod

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## A NEW AMERICAN COENONYMPHA (LEPID. SATYRIDAE).

BY DEMOREST DAVENPORT,

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### **Coenonympha tiphon mackenziei** ssp. nov.

*Coenonympha ochracea* : Cary, Proc. U.S. Nat. Mus. 31, p. 448; 1903.

Above brighter ochre than any American form except *subfusca* Barnes and Benjamin, from Arizona. The entire upper surface is a tawny ochre that in some males is dusted with gray near the margins. The fringes are nearly white and contrast sharply. Under side of the primaries lighter ochre, crossed by a very distinct, long postdiscal band of white; the margins are washed with gray-white. Lower surface of the secondaries gray or brown dusted over with grayish white and crossed by an irregular median band of white that in some specimens sends projections into the basal area. Apical ocelli on the primaries and submarginal ones on the secondaries are strong, obsolescent or not present at all.

The females are similar to the males.

*Holotype*—♂, July 4, 1926, Nyarling River, Mackenzie Dist. (J. Russell) No. 4066 in the Canadian National Collection.

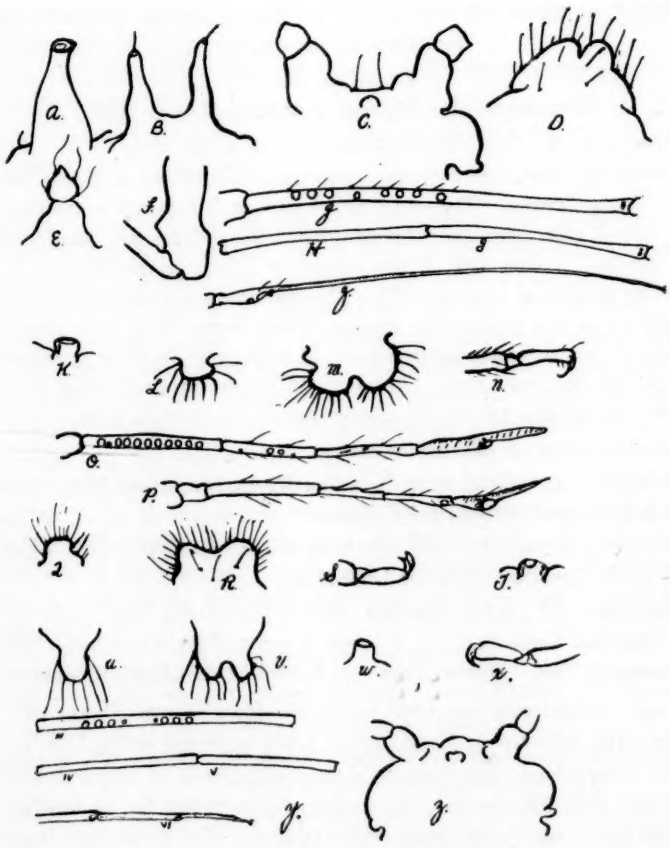
*Allotype*—♀, July 11, 1926, Nyarling River, Mackenzie Dist. (J. Russell) No. 4066 in the Canadian National Collection.

*Paratypes*—3♂, 1♀, Nyarling River, Mackenzie Dist., July 4, 11, in Canadian National Collection, 2♂♂, July 5, 1903, Fort Providence, Mackenzie River, Mackenzie Dist. (Merritt Cary), in United States National Museum.

*Range*—Apparently restricted to the vicinity of Great Slave Lake. Only two of the series collected by Cary (1903) could be found in the U.S.N.M.

This subspecies is very close to certain individuals of *ochracea* Edw. from Wyoming and Colorado but may be mainly distinguished by its brighter upper surface and its strongly contrasting white fringes. The writer has found in no American collections specimens of the true *ochracea*, Edw. from further north than Montana. *Mackenziei* seems to be completely isolated from its southern relative by the very distinct plains race *benjamini* McD.

The writer considers all American *Coenonympha* with the exception of *haydenii* Edw. to be subspecies of *C. tiphon* Rott, and hence describes this form as *tiphon mackenziei*.




*Drepanaphis allegheneyensis* (A-J) A—cornicle. B—dorsal abdominal tubercles. C—head. D—anal plate. E—cauda. F—tibio-femoral joint. G—antennal segment III. H—antennal segment IV. I—antennal segment V. J—antennal segment VI.

*Neosymydobius quercihabitus* (K-T) K—cornicle, alatae. L—cauda, alatae. M—anal plate, alatae. N—tarsus, alatae. O—antenna, alatae. P—antenna, apterae. Q—cauda, apterae. R—anal plate apterae. S—tarsus, apterae. T—cornicle, apterae.

*Myzocallis subulmifolii* (U-Z) U—cauda. V—anal plate. W—cornicle. X—tarsus. Y—antenna segments III, IV, V and VI. Z—head.

# THREE NEW SPECIES OF APHIDS.

BY FORREST W. MILLER,
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## **Myzocallis subulmifolii** n. sp.

Color: Entire body light yellow tinged with pale green; legs pale yellow; wings hyaline.

Measurements: Alate viviparae—Body length, 2.18 mm.; width across eyes, .435 mm.; hind tarsi, .115 mm.; antenna, 1.49 mm.-1.51 mm.; III, .53 to .57 mm.; IV, .30 to .34 mm.; V, .33 to .35 mm.; VI, .184 plus .115 mm.; cornicles, .023 mm. long. Cauda .06 mm. from neck, .115 mm. entire length.

Structural characteristics: Antennal tubercles only slightly extended, vertex slight. Secondary sensoria oval numbering 7-10 on III of the alatea; absent on the apterae. Hairs on the alatae are minute. Cauda knobbed. Anal plate bilobed. Cornicles smooth, not truncate. Radial sector faint. Media twice forked. Dorsal abdominal tubercles lacking.

Collections: On the under side of leaves of *Ulmus americana* in the Schenley Park district, Pittsburgh, Pennsylvania, May 21, 1932. Slide number (alate) No. 621-Pgh. No apterae.

Taxonomy: Specimens resemble *Myzocallis ulmifolii* (Monell) more closely than any other species of this genus. It differs from this one in lacking entirely in the dorsal abdominal tubercles and in a much larger size of the body.

## **Drepanaphis allegheneyensis** n. sp.

Color: Head and prothorax light brown, antennal segments concolorous with head. Metathorax and abdomen of a deep brown color. Cornicles concolorous with abdomen, cauda and anal plates of a lighter brown. Femur of the legs dark brown, remainder of the leg segments light brown. Wings hyaline, stigmal area only slightly fuscous.

Measurements: Alate viviparae—Body length, 2.55 mm.; width across eyes, .56 mm.; hind tarsi, .142 mm.; antenna, 3.32 mm., comparative lengths as follows: III, .984 mm.; IV, .568 mm.; V, .566 mm.; VI, .161 plus 1.019 mm. Secondary sensoria limited to III, 8-10 in number and arranged in a straight line on basal two-thirds of segment. Dorsal tubercles (abdominal), anterior pair separate at base, .142 mm., posterior pair separate at base, .213 mm. long. Cornicle .331 mm. long .165 mm. wide at base and .049 mm. wide at apex. Cauda knobbed, .142 mm. wide at base, .189 mm. long.

Structural characteristics:—Beak extending to second pair of coxae, secondary sensoria oval. Hairs robust. Cauda knobbed, anal plate bilobed. Radial sector dark, ends of veins deep fuscous. Dorsal tubercles (abdominal) widely separated at base.

Collection: On the leaf stems of *Acer saccharum*, Pittsburgh, Pennsylvania, June 20-30, 1932. Slide No. 460-Pgh.

Taxonomy: Differs from *Drepanaphis monelli* (Davis) in antennal characteristics, body color and abdominal tubercles.

**Neosymdobius quercihabitus** n. sp.

Color: Head and thorax dark brown. First and second antennal segments slightly lighter; remaining segments with distal one-third deep brown and proximal two-thirds light in color. Mesothoracic and metathoracic legs uniformly brown in color; prothoracic legs lighter. Stigma of fore wings only light fuscous; remainder of wings hyaline.

Measurements: Alate viviparae—Body length, 1.56 mm.; width across eyes, .414 mm.; hind tarsi, .161 mm. Comparative antennal lengths as follows: III, .32 to .35 mm.; IV, .24 to .26 mm.; V, .19 to .21 mm.; VI, .138 plus .115 mm. Secondary sensoria on III and IV, twelve on III and three to four on IV and are in straight line along length of segment.

Apterous viviparous female—Body length, 1.47 mm.; width across eyes, .404 mm.; hind tarsi, .115 mm. Antennal lengths as follows: III, .299 mm.; IV, .161 mm.; V, .184 mm.; VI, .092 plus .098 mm. Anal plate, .092 mm. long, cauda, .046 mm. long and cornicle .046 mm. long.

Structural characteristics: Secondary sensoria on III and IV large and oval. Beak extends midway between the pro- and mesothoracic coxae. Prothorax contains prominent pair of lateral tubercles. Fore wings with media twice branched. Costal area of wings clear in color, wings entirely hyaline. Abdomen with dusky lateral patches which contain small circular sensoria. Cornicles short with sides parallel, cauda knobbed only slightly, anal plate distinctly bilobed and covered with long hairs.

Taxonomy: Near *Neosymdobius albasiphus* (Davis) but differs in number of sensoria of antenna, greater lengths of segments III, IV and VI, color of body and length of beak.

Collections: On the under side of leaves of *Quercus campestris*, Woods Hole, Massachusetts, July 9, 1930. Slide No. 730-WH.

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## AN UNDESCRIBED PEDICULOIDID MITE FROM THE SOUTHERN APPALACHIANS.

BY ARTHUR PAUL JACOT,
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The Pediculoididae are so strongly sexually dimorphic that there is little resemblance between the sexes, necessitating two sets of keys. As I am particularly interested in the females, they only are here discussed.

In *Pediculoides* the abdomen tapers posteriad to a blunt point, in all the other genotypes the abdomen is more or less truncate and angular behind. *Pygmephorus* (often misspelled) has tarsi I swollen and much longer than tibiae I. In *Pediculopsis* they are subequal. *Resinacarus* also has large tarsi I. In figure 12* the line around the middle of tarsi I is to be taken as a constriction rather than a segmental boundary. The bristles of legs I are not identical in figures 9 and 12, nor are the bristles of dorsal plates I and III. *Resinacarus* has three pairs of prothoracic bristles while the type of *Pygmephorus* has two pairs. We thus have

*Vitzthum, Hermann, 1927 (May), Die Acarofauna der Harzflusse, Sitzungsberichte der Gesellschaft naturforschender Freunde, pp. 89-110, 15 figs.

the key:

GENERIC KEY TO FEMALES

1. Abdomen tapering posteriad to a blunt point *Pediculoides*
1. Abdomen truncate, angled behind 2
2. Tarsi I subequal to tibiae I, dorsum of prothorax with three pairs of bristles, the interpseudostigmatic very long (nearly equal to length of body) *Pediculopsis*
2. Tarsi I more or less swollen, much longer than tibiae I 3
3. Dorsum of prothorax with three pairs of bristles, the interpseudostigmatic not long *Resinacarus*
3. Dorsum of prothorax with only one or two pairs of bristles, none of them longer than cephaloprothorax *Pygmephorus*

## **Pygmephorus arvorum** sp. nov.

Figures 1 to 4

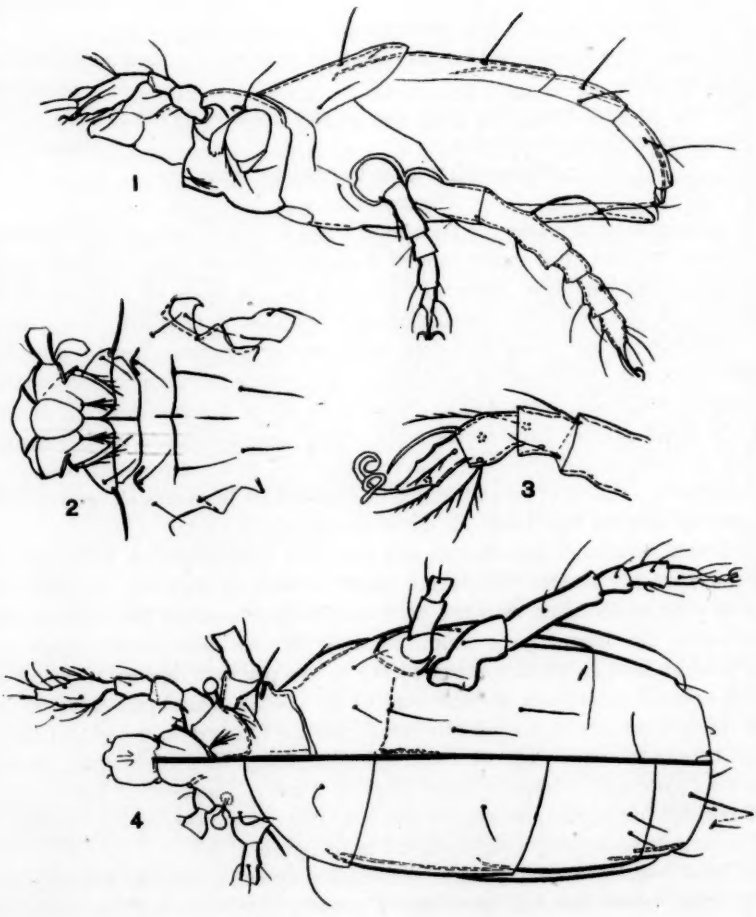
*Diagnostic characters* (of females): Tarsi I, tarsi II, tibiae II, parasterna I with ciliate bristles; tarsi I with curved dorsolateral spine; legs IV much stouter and longer than other legs; femora IV twice as long as tibiae IV; bristles of posterior edge of abdomen short; mesal bristle of parasterna II spinose, conspicuous.

*Description* (of females): As usual, rather colorless; length 0.19 mm., breadth 0.076 mm.; procephalon as wide as long, rather rectangular, anteromedian part slightly projecting; postcephalon rounded in dorsal aspect (figure 4), prothorax fairly broad at base, bare, widely overhanging pseudostigmata, with a medium long bristle (interpseudostigmatic) inserted on edge, posterolaterad of position of pseudostigmata (figure 4); pseudostigmatic organs with long pedicel, head cylindrical, hanging between legs I and II, distal end scalloped (figure 1).

Dorsal bristles of post-thorax and abdomen well developed, lateral bristles of dorsal plate III shorter than mesal, lateral bristles of plate IV medium long, posterior edge of abdomen with two pairs of bristles, the mesal pair approximate, rather short, the lateral quite short, strongly directed downward (figure 1); mesal pair of bristles of parasterna I five to six partite (figures 1, 2 and 4), inserted on small lapets near anterior edge of parasterna, lateral pair three or four ciliate, fairly long, inserted on posterolateral corner (figures 1, 2 and 4); lateral pair of bristles of parasterna II stout, spinelike, long, directed laterad, inserted on lateral corner of a triangular lapet (figures 2 and 4), mesal pair inserted near lateral edge of parasterna; bristles on posterior edge of parasterna III fairly long, other ventral bristles fairly long, disposed as in figure 4.

Tarsi I with a curved spine on dorsolateral aspect, a sensory club on lateral face, a ciliate bristle inserted proximad of sensory club, a barbed dorsoproximal bristle and a smooth one (figures 1 and 4), unguis small; tibiae II with a long dorsodistal spine extending slightly beyond tarsus (figure 3); femora IV with dorsal bristles inserted at center of segment, fairly long (figure 1), the ventral bristle also inserted at center of segment, of normal length.

*Material examined*: One hundred specimens from soil sample of tall-weed old-field abandoned four years, eight miles southwest of Asheville, North Carolina; taken November 26th 1934, slides 34F19B1, -B2, -B5, -B6 (*cotypes*, to be deposited at the United States National Museum). One specimen, same locality,




*P. arvorum sp. n.*

1, lateral aspect, leg II omitted, procephalon extended, prothorax bent upward; x 594. 2, ventral aspect with anterior end of specimen tilted up so as to be somewhat cephaloventral, so that the various lapets stand out in greater relief, legs omitted (except trochanters I and IV of one side), pseudostigmatic organ of one side only; x 594. 3, lateral aspect of tarsus and tibia II, the ungues abnormal; x 890. 4, ventro-dorsal aspects, legs partially omitted, procephalon extended; x 594.

taken April 5th, 1935, slide 34F29a1. Two specimens from Andropogon sod (old-field abandoned twenty years), top of hill (Glen Bald), Bent Creek Experimental Forest, ten miles southwest of Asheville; taken April 17th 1935, slide 34F31-a4.

## THE ENTOMOLOGY OF PRINCE ALBERT NATIONAL PARK, SASKATCHEWAN.

BY T. D. A. COCKERELL,

University of Colorado.

Last September, my wife and I visited the Prince Albert National Park, particularly to see Grey Owl and Anahareo and the beavers at Ajawaan Lake. The country was entirely new to me, and I found very much of interest. Saskatchewan is divided into two very different parts. The southern half has some large lakes, but is essentially a prairie region, where vast quantities of wheat are grown. As we crossed a portion of it travelling from Calgary to Saskatoon, the landscape was monotonous and not very interesting. But the northern half of the province is in complete contrast. It is a land of dense forests, with innumerable lakes, large and small. These lakes are warm enough in summer to be the delight of innumerable bathers, but covered with thick ice all winter. This region is in the Canadian zone, whereas the prairie region belongs to the Transition. In the northern (especially north eastern) part of the province is a large area in the Hudsonian zone, sufficiently distinct in aspect to be easily recognised from an aeroplane, I was informed.

All this country was glaciated during the pleistocene. When the ice went off, the northern part appears to have been repopulated from the east the southern part at least largely from the west and south. So it happens that although Prince Albert Park is about 900 miles due north of Boulder, Colorado, where I live, its biota is much more eastern in character than that of the same longitude in Colorado. The robin is the eastern bird, not the western robin; the Canada jay (*Perisoreus*) is the typical eastern race, not the Rocky Mountain subspecies; the beaver is *Castor canadensis,* not *C. canadensis frondator.* At the same time, the Circumpolar biota appears to be well represented, and the whole aspect of things is northern, although the latitude is actually about the same as that of the north of England. Of thirteen species of spiders collected at Waskesiu, no less than seven also occur in Europe.

The country is exceedingly beautiful, and was especially so at the time of our visit with the red and yellow leaves in the forest, contrasting with the dark conifers, and the innumerable agaries, of many colors. It was, however, late in the season for insects, so that I got only a single bee, only one grasshopper, only one kind of sawfly (not counting larvae), only a single mayfly. In the summer collecting would undoubtedly be good, if we may judge by the varied flora, and the environment so suitable for aquatic insects. For our transportation within the Park we were entirely indebted to Major J. O. Wood, the superintendent, who arranged for us to see as much as possible in a short visit. We travelled in a canoe the whole length of Waskesiu Lake (some fifteen miles), and across Kingsmere Lake, and so on to Ajawaan Lake, where Grey Owl has his cabin. On an-

other occasion we went through the Lakes of the Hanging Hearts, and on to the large Crean Lake. The Lakes of the Hanging Hearts take their name from a legend that two bands of Indians had a battle there. The victors killed all their enemies, and hung their hearts on the trees.

## Spiders.

I am indebted to my ever kind friend Mr. W. J. Gertsch for promptly identifying the spiders I collected, and indicating their known distribution. I give the list just as he gave it. The number of specimens is indicated in each case.

(1.) Waskesiu.

2. *Orodrassus vastus* (Banks). Northwestern U.S. and Canada. The only typically western species of the collection.
8. *Linyphia insignis* Blackwall. Northern U.S. and Canada; Europe.
1. *Linyphia pusilla* C. Koch. Northern U.S. and Canada; Europe.
1. *Pityohyphantes phrygiana* (C. Koch). U.S. except southwestern part; Canada; Europe.
1. *Theridion frondeum* Hentz. Eastern U. S.; all Canada.
6. *Dismodicus decemoculatus* (Emerton). Northeastern U.S. and Canada.
1. *Philodromus rufus* Walkenaer. U.S. and Canada; Europe.
1. *Philodromus aureolus* (Clerck). Northern U.S. and Canada, Europe.
2. *Paraphidippus marginatus* (Walckenaer). U.S. and Canada.
7. *Tetragnatha extensa* (Linnaeus). U.S. and Canada; Europe.
3. *Tiballus oblongus* (Walckenaer). U.S. and Canada; Europe.
1. *Clubiona canadensis* Emerton. Northern U.S. and Canada.
2. *Pardosa xerampelina* (Keyserling). Northern U.S. and Canada.

(2.) Crean Lake.

Six species which are also in the Waskesiu list, namely *Paraphidippus marginatus, Tetragnatha extensa, Linyphia pusilla, Pardosa xerampelina, Philodromus aureolus* and *Dismodicus decemoculatus.* Also the following additions to the Park list:

1. *Aranea displicata* (Hentz). U.S. and Canada.
4. *Ebo pepinensis* Gertsch. Northern U.S. and Canada.
1. *Misumena vatia* (Clerck). United States and Canada; Europe.
1. *Theridion zelotypum* Emerton. Northern U. S. and Canada.

Mr. Gertsch remarks that the only two species sent which can be regarded as typically eastern are tiny Micryphantids, *Ceraticelus fissiceps* and *Dismodicus decemoculatus.* For the latter there is a single more western record in British Columbia. The *Ceraticelus* was taken in Alberta, not in the Prince Albert Park. I collected spiders in three other localities, as follows:

(1.) Banff, Alberta; alt. 4560 ft.

*Tibellus oblongus* (Walckenaer). *Pardosa xerampelina* (Keyserling).
*Xysticus* sp., juv. *Dictyna volucripes* Keyserling.
*Clubiona canadensis* Emerton. *Ceraticelus fissiceps* Cambridge.

Three of these were also at Waskesiu. *C. fissiceps* has a few records from northwestern U. S. and Canada, but is more typically eastern.

(2.) Lake Louise, Alberta; alt. 5600 ft.

*Pityophantes phrygiana* (C. Koch.).

(3) Billings, Montana.

*Tetragnatha laboriosa* (Hentz.) *Dictyna volucripes* Keyserling.
*Misumenops asperatus* (Hentz.) *Dictyna* sp., juv.

**Sawflies.**

*Fenusa dohrnii* (Tischbein).

I obtained two specimens, the only adult sawflies seen. It was determined by Dr. Herbert H. Ross, and when I found it was supposed to be an introduced species (it was originally described from Germany), I wrote asking whether it might not be circumpolar after all. Dr. Ross replies: "I am quite certain that this species is truly holarctic in distribution. I have several records of it from across the continent I believe that a large number of sawflies classifed as introduced are in reality holarctic, but owing to the freakish nature of their occurence they are not found very frequently."

*F. dohrnii* is a leaf-miner on *Alnus* and *Ulmus*.

**Bees.**

*Bombus terricola* Kirby. One specimen at Crean Lake, Sept. 11. This typically northern species was the only bee I was able to find in Prince Albert Park during the middle of September. It was therefor rather surprising, when later visiting the Canadian Rockies, at much higher altitudes, to find *Bombus* flying freely. At Banff I took *B. flavifrons* Cresson, Sept. 19; and at Lake Louise (5,600 ft.), on Sept. 21, *B. bifarius nearcticus* Handlirsch, *B. occidentalis* Greene, and *B. melanopygus* Nylander. At Calgary, as might be expected from the different type of country, the species were quite different: a male *B. nevadensis* Cresson, Sept. 6, and workers of *B. ternarius* Say and *B. huntii* Greene, Sept 6 and Sept. 18, respectively.

In the collection of the University at Saskatoon, I saw the following collected in that locality, and determined by Viereck: *Halictus cressoni* Robertson, variety; *H. provancheri* Dalla Torre; *H. trizonatus* Cresson; *H. lerouxii* Lepeletier; *Agapostemon texanus subtilior* Ckll.; *Megachile latimanus* Say; *Bombus terricola* Kirby; *B. ternarius* Say.

I took *A. texanus subtilior* at Calgary, Sept. 6, and at Billings, Montana, Sept. 24. At Calgary, Sept. 6, I also found *Andrena costillensis* Viereck and Cockerell (at flowers of *Chrysopsis*) and a male *Halictus cooleyi* Crawford. At Billings I also got a male *Agapostemon splendens* Lepeletier and a male *Sphecodes lautipennis* Cockerell, the latter differing from the type in having the base of the abdomen without a red patch, as well as a female *Megachile brevis* Say. These were all the bees obtained on the trip.

**Mayflies.**

*Tricorythodes explicatus* (Eaton). A single female, taken at Crean Lake, was the only mayfly I could find in the Park in September. It was determined by Dr. McDunnough, who has discussed the species in Canadian Entomologist, 1931, p. 267. It was originally found somewhere near the Arizona-Mexico border, in a very different environment. Dr. McDunnough records it from Waskesiu Lake (King) and various other northern localities, and comments on certain differences observed, but concludes that the variation does not exceed specific limits. The species is of particular interest to me, because I studied it in 1906 (University

of Colorado Studies, 121, p. 135), and noted that it appeared in Colorado at the very end of the season. I inferred, therefore, that it could not extend northward, and hence was unprepared to find it 900 miles north in the Prince Albert Park. Dr. McDunnough writes: "I do not think that the northern location has much to do with retarding development in many Ephemerids. Most of their life is spent in a nymphal state and quite a bit of growth occurs during the late fall and the early spring months even though the water is cold and ice may be over the surface, and there is sufficient heat in the water in the summer months to speed up development sufficiently for the adult insect to emerge in the fall."

### Craneflies.

*Helobia hybrida* Meigen. Crean Lake, in Prince Albert Park, Sept. 16; also Banff, Alberta, Sept. 20, and Billings, Montana, Sept. 24. This abundant species occurs throughout the Holarctic Region. Dr. C. P. Alexander, who identified it adds: "Edwards has informed me that he has looked up the original reference to *Helobia* Curtis, and finds that it pre-empts the use for the Crane-fly by two years. As a consequence we will apparently have to use the generic name *Symplecta*, and the species should be recorded as *Symplecta hybrida* (Meigen)" (litt. Nov. 20, 1935). The only other Tipulidae obtained belonged to the genera *Limonia* (*Dicranomyia*) and *Trichocera*, and cannot at present be determined.

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## MISCELLANEOUS PHYSIOLOGICAL OBSERVATIONS ON THE LABORATORY BREEDING OF FLESH FLIES AND OF *MELANOPLUS BIVITTATUS* SAY.

BY A. W. A. BROWN,
Department of Biochemistry, University of Toronto.

The species of flesh-fly under consideration are *Wohlfahrtia vigil* Wlk., *Calliphora erythrocephala* Mg., and *Lucilia sericata* Mg.

Oviposition under laboratory conditions occurred in most cases at night. Under outdoor conditions wild individuals of these species were observed to oviposit only during the day. Lack of disturbance in the cages is suggested as the deciding factor, since temperature and light were kept constant night and day. The site of oviposition preferred is the undersurface of a dry ledge of the meat. On being disturbed the ovipositing female is loth to leave the site.

On hatching, the larvae immediately burrow into the meat in a solid rank or cluster (N. B. *Wohlfahrtia* is larviparous). Any stragglers die of starvation, since alone they cannot excrete enough ammonia to liquefy the meat and produce in it a reaction alkaline enough to allow the optimum operation of the larval trypsin, which passes out in an active form in the excreta (Hobson, 1932).

Hitherto it has been technically difficult to obtain exuviae from larvae of such food-habits. By chance, it was found that the use of a porcelain plate furnished an excellent method. The newly shed exuviae fall to the surface of the plate, which absorbs liquid from them, so that when the meat and larvae are removed the exuviae remain as light brown spots on the plate.

Upon being fully gorged the larvae will leave the liquefied meat in a characteristic fashion. Larvae only half-gorged may, however, be induced to leave,

either by denying them food for two days or by putting them, together with the meat, at 4°C for a longer space of time. It is suggested that the amount of fat laid down in the body may determine cessation of feeding.

It is possible for meat to be too putrescent to allow the growth of maggots, especially blown meat placed at low temperatures. Putrefying bateria, which can operate—though slowly—at these temperatures, successfully eliminate the larvae, which cannot. The putrefaction spreads to the larvae, manifesting itself either in the larval stage or at pupation.

The characteristic reaction of the larvae on leaving the meat is strongly negatively phototropic and positively thigmotropic. Such tropisms lead them into a favourable site for pupation. The act of pupation appeared to require three factors—(1) darkness; although light will not altogether inhibit, (2) sufficient humidity, and (3) a temperature of approximately 20°-30° C.

With regard to humidity it has been quantitatively determined (Evans, 1935) for *Lucilia sericata,* and by other workers for other species including *Calliphora erythrocephala,* that high humidity retards and low humidity accelerates pupation. In face of this conclusive evidence, however, the following finding is reported; prepupae (of *Lucilia* and *Calliphora*) were put in sawdust in two earthenware crocks; the one left open, the other closed with a lid. In the latter, pupation was complete within 4 days. The contents of the open crock, however, on careful examination one month and 7 days later, showed only 5% pupation; and the prepupae and pupae had become so small as to pass easily the meshes of a gardener's sieve which withheld all the pupae of the closed crock. The sawdust of the open crock had become bone dry. The factor of temperature was not controlled; Cousin (1932) reports the induction of a diapause in prepupae by low temperature, and claims also that completely dry air will give the same effect.

The effect of delayed pupation, and consequent loss of weight by evaporation and metabolism, on size was often well demonstrated. The adult flies from such prepupae were extremely small, less than half the normal size in linear dimensions, and less than one-eighth in weight. Such specimens were obtained in both *Lucilia* and *Calliphora.* It is therefore suggested that delayed pupation may be another factor, in addition to larval food supply, which causes the traditional variation in size of muscoid flies, well-known to taxonomists.

The darkening of the larval integument to form the puparium is known to be due to the production of melanin pigments from tyrosine by oxidative enzymes. The oxidative nature of this darkness may be demonstrated in this way: "white pupae" may be stuck to a glass surface, so that at pupation all the integument may be seen to be darkened except that part adhering to the glass; on being detached, that white area will darken within an hour. The existence of enzyme and substrate within the bodies of the white prepupae may be demonstrated by grinding them in a mortar and thus exposing the tissues to the air; within 15 minutes (for *Lucilia,* 45 minutes for *Calliphora*) they will be of a dark chocolate colour.

Pathological conditions at pupation, which appeared to be caused by too dry conditions, were of two types. The first, the extreme, was where the pupae

were much elongated, the segments standing out; such individuals never developed. The second, and less extreme condition, could be recognized by excessive blackness of the puparium; from these adults never emerged, but on dissecting them fully-formed pigmented adults would be disclosed. It is suggested that there was excessive hardness of the puparium which the emerging fly could not break; this was also noted by Garlick (1934) for the grape berry moth. Evans suggested that non-emergence under too dry conditions was due to the too rapid drying up of the moulting fluid secreted just before emergence.

It was observed for *Calliphora* that broods which had pupated, passed their pupal life and emerged at 28°C and 70% relative humidity, contained a high percentage of "monsters," manifested by outspread wings which would not close, wing atrophy, ranginess of limbs and consequent lack of coordination, and abdominal atrophy. Such individuals died within a day or two. On the other hand, (a) broods with pupation and pupal period at this constant high temperature and humidity and emergence at room temperature and humidity, and also (b) broods with pupation and pupal period at room conditions and emergence at these "hothouse" conditions, were quite normal. This phenomenon was not shown by *Lucilia*.

Following are average figures for the times of the principal events in the life-cycle of *Calliphora erythrocephala*, given in days after oviposition:— (Larvae and pupae at 28°C and 70% relative humidity. Adults and eggs at 25-35°C and 40% relative humidity).

| Hatching | Leaving food | Pupation | First emergence | Last emergence | First oviposition | Last death |
|---|---|---|---|---|---|---|
| 11 hrs. | 4½ days | 7½ | 15¼ | 16½ | 23 | 31½ |

The 'forcing' nature of these breeding conditions is brought out by a comparison with the figures of Cousin for the same species at summer temperatures in France:—

| | | Duration of periods in days | |
|---|---|---|---|
| | | Larval period | Pupal period |
| Cousin | 18-20°C | 11-12 | 13-14 |
| In this research | 28°C | 6½-8¾ | 6½-9¾ |

These conditions of rearing are not recommended for keeping a stock, since they caused a high percentage of atrophy at emergence, and sterility of eggs laid by the second generation. (*cf* Young and Plough, 1926, for *Drosophila*).

The following note on *Melanoplus bivittatus* is occasioned by a paper by Hodge (1933), in which he reports a high mortality and foreshortened adult life (48 hours) in *Melanoplus differentialis* Th. on a restricted diet of the outer leaves of lettuce.

It was found possible last spring to rear from egg to maturity large numbers of *Melanoplus bivittatus* on a diet of whole lettuce heads alone. The lettuce was from California, such as is on the market in Toronto during the winter; fresh heads were added every two days, and a constant supply of distilled water was given. Although mortality was high throughout all stages, yet most of the adults lived long, some surviving 47 days as adults before the experiment was terminated. Copulation was frequent, and sporadic oviposition occurred. The eggs were collected around Brandon, Manitoba, in September by Mr. H. W. Moore, through the kind cooperation of Dr. R. D. Bird of the Dominion Entomo-

logical Laboratory at Brandon. They were kept at 50°C until they were removed for rearing; when taken out in January the percentage hatch was high; subsequent hatchings in March and April gave lower percentages. The nymphs took 50 days to reach the adult stage at room temperature, and 22 days at 29°C.

Finally, it cannot be too much stressed that the above observations, being qualitative only, are in the nature of suggestions rather than of experimental deductions.

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Evans, 1935, Parasitology *27*, 291.
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Hobson, 1932, Jour. exp. Biol. *9*, 128.
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Young and Plough, 1926, Biol. Bull. *51*, 189.

## BOOK NOTICE.

The Biology of Mayflies with a Systematic Account of North American Species by James G. Needham, Jay R. Traver and Yin-Chi Hsu assisted by Specialists in Certain Subjects. Pp. XVI + 759, 42 plates, 165 figures. The Comstock Publishing Co., Ithaca, N. Y. 1935. List price $7.50.

The present work brings up to date and gathers into one volume the chief facts which are known regarding the biology of mayflies and the taxonomy of the North American species. For the past thirty-five years Dr. Needham has been intermittently engaged in the study of mayfly problems and under his guidance several students have investigated special phases of mayfly biology, morphology and taxonomy. This volume represents the culmination of these studies and observations.

The book is divided into two parts preceded by an Introduction containing a brief account of the work of early investigators. Part I discusses Mayflies in General. In few groups is the integration between form and function more clearly exemplified than in the Ephemeroptera, hence several chapters deal rather elaborately with Mayfly Anatomy, External and Internal, particularly of the nymphs. Other chapters treat of the types of eggs in the principal genera with figures and tables for their identification and an account of Egg Development and Oviposition. Chapters are included on the Life Cycle in Mayflies with a detailed account of the Post-Embryonic Development of three species. Special chapters deal with the structure of the Wings and Legs, Body Wall and Musculature of the Thorax. Nymphal Structures and Adaptations are dealt with elsewhere and there are brief chapters on Mayfly Phylogeny, Casualties and Enemies of Mayflies, and Values and Uses of Mayflies. Part I concludes with Instructions for the Collecting, Preservation and Rearing of Mayflies and a resume of the traditional systems of classification.

Part II, largely the contribution of Dr. Traver, consists of a Systematic Account of the North American Species in both adult and nymphal stages. Five hundred and seven species are treated, disposed in forty-seven genera. Keys are provided for the identification of adults and also nymphs where the latter are

known. The keys are supplemented by verification tables tabulating characters of special importance in classification. Under each genus the species are arranged alphabetically with the citation of literature pertaining to each. Both adults and nymphs are diagnostically described with notes on the type material and the source of specimens studied by the authors. The volume concludes with an extensive bibliography and an index.

The rearing of Mayflies is attended by serious difficulties and requires an infinitude of care and patience on the part of the investigator. This is attested by the fact that until 1935 only a single species of mayfly had been reared from egg to adult with a complete record of all nymphal instars. Complete or very nearly complete records are given by the authors for three additional species, all of the subfamily Heptageninae. It is regretted that the authors did not find the opportunity for more extensive life history studies especially among the members of other subfamilies.

The food habits of the nymphs might have merited further study. In this connection the authors have omitted a discussion of Muttkowski's studies on the Ecology and Food of Trout stream Insects (Bul. N. Y. St. Coll. Forestry, Roosevelt Wild Life Ann. Vol. II, No. 2, pp. 147-263, 1929).

With the authors' statement (p. 231) that "the simplest, most efficient, and most permanent preservation of mayflies in all stages is had by putting them in alcohol of 70 to 80 per cent. strength" and their disparagement (p. 231, paragraph 3) of pinned adult material as a mode for preserving types and museum collections, the writer must disagree. Mayfly adults do not lend themselves as readily to any method of preservation as do many less fragile insects; nevertheless the writer believes that pinning is greatly superior to alcohol for the adults. The readiness with which legs become detached in manipulating alcoholic specimens is only too well known and every observation of the material is necessarily accompanied by actual handling of the specimens which sooner or later results in some damage. In addition alcoholic specimens lose their characteristic colors and color patterns rapidly which should be a decided disadvantage to the authors who use color so extensively (and necessarily) in their keys to species. There is the added danger of evaporation with alcohol and as for types the writer's experience has been that some of the most poorly preserved types in existence are alcoholics and almost all alcoholics are poor as regards color if of any considerable age.

In the systematic portion of the book the authors have taken great care to provide means for the ready and accurate identification of species. To this end they include extensive keys, verification tables, figures of genitalic structures and comparative notes. To the specialist the arrangement of species in the text according to their taxonomic affinities rather than alphabetically would be perhaps more pleasing. The authors have evidenced great pains to be certain of the correct identity of all species dealt with by them but in a considerable number of cases have seen no actual specimens, relying in such instances on the descriptions and notes of other workers. This is especially true of a number of Canadian species, the types of practically all of which are available for study and within a day's journey. It is to be regretted that they did not find the time or means to study these

for while it may be possible to formulate workable keys from the literature alone, a firsthand knowledge of types or specimens is greatly to be preferred.

The difficulties encountered in the production of a manual of the Mayflies are much greater than those attending a treatise on one of the better known orders where the preliminary problems of morphology, embryology, ecology and taxonomy have long been subjected to investigation and have been carefully evaluated and reduced to a relatively stable basis. As the first general manual in this much neglected order this volume will be highly regarded by both the amateur and professional student of Mayfly problems. The student will find in it a wealth of information, hitherto largely unavailable because of its widely scattered nature, now co-ordinated and presented in an instructive and fascinating manner. For the teacher of biological principles it will prove a most valuable source-book. The experienced morphologist and taxonomist will find the book indispensable in the pursuit of special problems. The senior author possesses that rare faculty for presenting scientific information in a delightfully entertaining manner without the sacrifice of scientific accuracy. To him, as well as to the junior authors and others who have contributed towards the making of this book, entomological workers owe a distinct debt of gratitude. G. S. WALLEY.

## RESEARCH NOTES.

### AN INSECT INJURING SUNFLOWERS IN MANITOBA.

The sunflower growers of Manitoba have become somewhat alarmed since the appearance, in 1935, of an insect of injurious habits. This insect (*Homoeosoma electellum* Hlst.) is of particular importance in the vicinity of Morden and Horndean, where the Mennonite settlers grow large quantities of sunflowers and use the seeds for human consumption. It has also been reported from the vicinity of Brandon and Hayfield. The insect is well known in Iowa where it does considerable damage but it has not previously been reported from Manitoba.

The only damage observed by us was to the heads of the sunflowers but Mr. R. H. Painter, who first observed the insect, reported that the leaves and stalks were also attacked in the outbreak at Horndean. Brown patches may be observed among the florets when the larvae are found on the flower heads. Later the heads turn black but show a whitish tinge at the surface which is due to the production of silk. The debris causing the blackish coloration is composed of dead florets and castings entwined with silk. The larvae are usually found under this debris, but also tunnel in the disc or into the seeds which they devour. In addition they may be found at the edge of the disc under the bracts of the involucre. In several cases observed in the field, the heads folded upwards assuming a V-shape.

The adult is a delicate grey moth measuring about one half inch in expanse of wings. It was identified by Dr. J. H. McDunnough. The larva is a brownish striped caterpillar, about 15 mm. long when fully grown.

Mr. Allen, who reared the insect, could find only four larval instars. Three to six days was spent in the third instar, seven to sixteen in the fourth, three to six days from the spinning of a cocoon within the flower head to pupation, and sixteen to twenty-four days in the pupal state. Adults emerged in the

laboratory from September 3 to 29 and oviposited on sunflower heads. The average life cycle is a month. No data has been secured on overwintering.

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## NEWS AND VIEWS

### NEW SECTIONS IN CANADIAN ENTOMOLOGIST.

Entomologists, in common with other human beings, have experienced their periods of trial and discouragement during the past few years. One form of discouragement has been the increasingly difficult task of publishing scientific articles, due to restricted space in many journals which has been caused by financial stringency. The difficulty of publication has become so directly proportional to the size of the article that it has reached the point where the outlook for an author with work of monographic proportions is distinctly disheartening. To say the least, this is very unfortunate and it might well be that more financial support from outside sources to scientific journals would surely yield generous returns in proportion to the outlay.

When a scientific paper is accepted for publication it is often about a year before it appears in print. This tends to greatly lengthen the period between the time that a piece of work is completed and the actual presentation of the results to the public. Part of this difficulty, however, may be overcome by the publication of short advance notes on new findings. When these are presented in the form of short items prompt publication can sometimes be assured. It is hoped that the Canadian Entomologist may now be able to be of some service in this regard. Brevity is a natural essential. Short notes on any new technique developed or notes on new findings or observations in entomological research work will now be given consideration by the editors. These items will be carried under the heading of "Research Notes."

It is felt that constructive discussions on scientific topics have a place in a science periodical of this kind. It is also desirable that we know the place and dates of meetings of scientific societies and any news of general interest to entomologists. In the latter regard, however, the fact that Mr. Dodo visited Aukville but returned without definite accomplishments might have its proper place provided in the social column of the daily newspapers. If, on the other hand, the aforementioned gentleman made some noteworthy observation or contribution during the course of his temporary geographical displacement the matter then becomes of immediate interest to his fellow scientists and thus well worthy of record. Short contributions to scientific discussions and interesting news items will be welcomed. These will be published under the heading of "News and Views."

A scientific journal should necessarily aim to raise rather than lower its scientific status. There is no intention, nor necessity, of lowering that standard in the present case but rather there is the expression of a desire that the 'Canadian Entomologist' should endeavor to embrace matters of somewhat wider interest than hitherto and thereby, it is hoped, increase its usefulness.

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